6.4 Assessment of the Potential Impact of the Waste-to-Energy Plant and Non-Hazardous Waste Landfill on Public Health in Cross-Border Areas

This chapter covers the assessment of the potential impact of the Waste-to-Energy (WtE) plant and the Non-hazardous waste landfill on public health in cross-border areas.

The Location where the Eco Energy complex is planned to be built is approximately 750 meters from the border with Romania. On the other, side of the Danube River, on the Romanian side, there is undeveloped land. The closest Romanian settlements to the project site are:

- **Izvoarele** – located approximately 4 km north of the project site. According to the population census, the village has 951 residents.
- **Gruja** – a settlement in Romania and the seat of the municipality of the same name. It is located in Mehedinți County, Oltenia, about 7 km east of the project site. According to the population census, the village had 1.890 residents.

The project site is located about 9 km from the Bulgarian border. The nearest settlements are:

- **Balej Village** – located in northwestern Bulgaria in the municipality of Bregovo, Vidin Province, at a distance of approximately 10,5 km from the project site. According to 2011 estimates, Balej had 437 residents.
- **Kudelin Village** – also located in northwestern Bulgaria in Vidin Province, at a distance of approximately 10,6 km from the project site. According to the 2021 census, the village had 229 residents.

The Health Impact Assessment (HIA) is a multidisciplinary methodological framework that enables the identification and quantification of possible positive and negative effects of the project on public health. This assessment considers various health determinants, including air, water, and soil quality, noise levels, and specific vulnerable population groups.

Given the nature of the facility and its proximity to the national border, it is important to analyze impacts that may have a transboundary character, particularly in the context of atmospheric emissions, potential watercourse pollution, the dispersion of heavy metals, and other harmful compounds into the environment. In this regard, this chapter provides an overview of the assessment methodology, key pollutants, their potential health impacts, as well as proposed measures to mitigate risks and protect the population in affected areas.

Objectives of the Transboundary Impact Assessment

The primary objective of this chapter is to analyze the potential health risks to the population that may arise from emissions and other environmental factors associated with the operation of the plant and landfill. The assessment includes:

- Identification of key pollutants that may have negative effects on human health.
- Analysis of possible exposure pathways for the population, including direct inhalation, contamination of water and soil, and indirect exposure through the food chain.
- Consideration of specific vulnerable population groups and their sensitivity to the analyzed risk factors.

- Comparison of pollution levels with relevant regulatory standards, including EU Directives, World Health Organization (WHO) recommendations, and European Environment Agency (EEA) standards.
- Proposing measures to mitigate risks, improve the environmental performance of the facility, and ensure continuous environmental monitoring (dedicated protocols, measures and monitoring programs are expressed in chapter 8 and chapter 9 of the EIA report).

The transboundary impact assessment process includes the following steps:

- Hazard identification – determining the presence of pollutants and assessing their potential impact on human health.
- Exposure assessment – analyzing pollutant concentrations in air, water, and soil in affected areas, as well as the frequency and duration of population exposure.
- Dose-response relationship determination – using established data to determine the exposure threshold above which adverse health effects are expected.
- Risk characterization – integrating all previous steps to determine the actual level of health risk to the population and developing appropriate mechanisms for risk reduction and management.

Importance of Cross-Border Health Impact Assessment

Environmental pollutants associated with waste incineration processes and landfill disposal can in theory have an impact on the environment and public health, not only in the immediate vicinity of the facility but also within a broader geographical context. Air pollution can spread over long distances through atmospheric diffusion, while water and soil contamination can be spread via surface an underground water flow.

6.4.1 Key Pollutants and Associated Health Risks

The health risk assessment evaluates the impact of key pollutants on human health and the environment, focusing on both their sources and mitigation measures. The following section outlines the primary pollutants of concern and their associated health risks.

- Particulate Matter (PM10, PM2.5)
    - Health Risks: Respiratory and cardiovascular diseases, increased hospital admissions, and premature mortality.
    - Mitigation: Advanced filtration systems, water spray systems, and regular air quality monitoring measures conducted.
- Nitrogen Oxides (NO_2)
    - Health Risks: Respiratory infections and lung function impairment.
    - Mitigation: Use of selective catalytic reduction (SCR) technology to minimize emissions and regular air quality monitoring measures conducted.
- Sulfur Dioxide (SO_2)

  - Health risks: Respiratory irritation and exacerbation of asthma.
  - Mitigation: Scrubbers and real-time emission control systems.
- Dioxins and Furans
  - Health risks: Long-term exposure can lead to cancer and developmental issues.
  - Mitigation: Activated carbon injection, input material control, flue gas scrubbing, SCR technology application and high-temperature combustion to minimize formation. Additionally, the residues from combustion are stabilized and solidified, before landfilling. Regular emission monitoring procedures.
- Volatile Organic Compounds (VOCs)
  - Health risks: Neurological and respiratory effects.
  - Mitigation: Use of activated carbon filters, full combustion using advanced bubbling fluidized bed combustion technology. Regular emission monitoring procedures.
- Heavy Metals (Lead, Mercury, Cadmium, Nickl, Chromium, Arsenic)
  - Health risks: Chronic exposure can result in neurological and kidney damage.
  - Mitigation: Proper waste handling, bag filter systems, active carbon injection, gravitational particle separation, flue gas scrubbing and air quality monitoring measures conducted. Additionally, the residues from combustion are stabilized and solidified, before landfilling.

When assessing health risks, it is crucial to consider the unique vulnerabilities of certain population groups. These groups often face disproportionate exposure or are more susceptible to the effects of pollution due to physiological, age-related, or health-related factors. This section highlights specific considerations for these populations:

- **Children**: Due to their developing respiratory systems and higher rates of air intake relative to body size, children are especially sensitive to air pollutants. Long-term exposure may lead to impaired lung development and cognitive deficits.
- **Elderly**: Older adults are at a heightened risk of cardiovascular and respiratory complications as they are more vulnerable to the cumulative effects of prolonged exposure to pollutants.
- **People with pre-existing conditions**: Those with conditions such as asthma, chronic obstructive pulmonary disease (COPD), and cardiovascular diseases may experience worsening symptoms and more frequent health crises due to pollution exposure.

To mitigate potential health and environmental impacts identified through the exposure assessment, the following measures are proposed:

- Air Quality Control:
  - Verification of advanced air filtration system operation adopted by the project holder. Please be referred to subsection 9 for details related to monitoring plan.
  - Continuous air quality monitoring at key locations. Please be referred to subsection 9 for details related to monitoring plan.

- Water Quality Management:
    - Verification of advanced wastewater treatment technologies operation adopted by the project holder. Please be referred to subsection 9 for details related to monitoring plan.
    - Regular water sampling and analysis. Please be referred to subsection 9 for details related to monitoring plan.
- Soil Protection:
    - Use of protective barriers and proper waste management to prevent soil contamination as adopted by the project holder. Please be referred to subsection 8 for details related to preventive measures.
    - Periodic soil quality assessments. Please be referred to subsection 9 for details related to monitoring plan.
- Noise Control:
    - Use of noise barriers and scheduling construction activities during daytime hours as adopted by the project holder.
    - Periodic noise level assessments. Please be referred to subsection 9 for details related to monitoring plan.

According to Science Report P6-011/1/SR1[1] the general public can be exposed to pollutants associated with incinerators through a number of routes, with direct inhalation and indirect entry via the food chain of particular importance. For many pollutants from a incinerator including some of the trace metals, and carcinogenic organic compounds (such as dioxins and furans), the major route of exposure is through the food chain.

6.4.2 Estimated assessment of the potential for the transboundary spread of odors

The maximal odor emission could be expected when the boiler is not in operation, considering that the ambient air from the inside spaces of the Waste-to-Energy pretreatment and storage facilities is used as a secondary air for the combustion process during regular operation. In the scenario of emissions during irregular operation, when boiler would not be in operation, the odors would be suppressed using a carbon filter. For such a case a dedicated air study executed by Faculty of Mechanical Engineering, University of Belgrade[2] comprised state-of-art diffusion modelling of TVOC as a surrogate model compound for odor release. The highest TVOC concentrations obtained by modeling, for averaging periods of 1h, 3h and 24h, can be observed immediately next to the northern border of the property and were 109 μg/m^3, 36,9 μg/m^3 and 5,59 μg/m^3, respectively. Considering the indicated limit value (400 μg/m^3) for TVOC concentration in indoor air, it can be concluded that the values obtained by the model are far below the specified limit.

During regular operations, i.e. boiler in operation, the results conclusively demonstrate that TVOC concentrations (as indicator of odor emissions) obtained by modelling are approximately 200 times

[1] Environment Agency, Health Impact Assessment of Waste Management: Methodological Aspects and Information Sources
[2] Study of the impact of the waste pretreatment filter system and activated carbon filter within the Waste-to-Energy Plant on the air quality of the wider location of the chemical industry complex in Prahovo

lower in worst circumstances than extremely stringent indicated limit value of 400 μg/m^3 for indor air quality. Thus, the emissions and potential odors are considered negligible on the Industrial complex.

Moreover, considering that due to the location of the chemical industry complex in Prahovo, there is a potential effect of cross-border pollution, and bearing in mind the trend of decreasing ground level pollutant concentrations for all averaging periods, where already after a few hundred meters from the boundaries of the complex the concentration becomes extremely low, it can be concluded that the potential cross-border effect is practically negligible'.

In practice, within cited study given figures (3.15 – 3.22), values anticipated in the territory of Bulgaria and Romania are below the scale of provided concentration (less than 0,5 μg/m^3 for a one-day averaging period).

6.4.3 Assessment of Transboundary Impact of Air Pollutants and Identification of New Risk Factors

The assessment of the transboundary impact of emissions from the Eco Energy complex is conducted to determine the potential influence of air pollutants on air quality in neighboring countries, primarily Romania and Bulgaria. This analysis is part of a comprehensive environmental impact assessment to ensure that emissions remain within acceptable standards and do not pose a risk to human health and ecosystems.

The primary objective of the modeling is to quantify the impact of these emissions and evaluate their dispersion in the atmosphere. Given the proximity of Romanian and Bulgarian borders, special attention has been paid to the possibility of pollutant transport beyond Serbia's territory. Meteorological conditions, dominant wind directions, and atmospheric stability have been considered to identify potential zones of increased pollutant concentrations.

Detailed information on the modeled emissions, limit values, and expected concentrations is available in chapter 6.2.1.1.5 of the EIA and supporting study[3].The modeling results enable the assessment of potential risks and the determination of compliance with national and international environmental standards, as well as recommendations for further emission management and the reduction of transboundary impact. The modeled emission sources include three stacks: the boiler stack, the solidification system stack, and the pretreatment system stack with activated carbon filter, as well as surface sources – non-hazardous waste landfill and the phosphogypsum landfill.

Arsenic

Arsenic is emitted into the atmosphere from waste thermal treatment facility in trace amounts, with other heavy metals. The primary sources of emissions are the thermal treatment of waste containing arsenic compounds and the dispersion of ash from the thermal process. Arsenic enters the human body through the inhalation of suspended particulate matter. Inhalation of arsenic can cause acute health issues such as coughing, difficulty breathing, chest pain, and respiratory tract damage. Long-term exposure may lead to more severe effects, including lung and skin cancer.

[3] Plant for energy utilization of waste and landfill of non-hazardous waste impact on air quality of the wider location of the chemical industry complex in Prahovo, April 2024, Faculty of Mechanical Engineering of the University of Belgrade.

The emission limits for arsenic are not regulated individually, but as part of the total heavy metal emissions (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V), with values ranging from 0,01 do 0,3 mg/Nm^3 according to BAT-AELs[4].

In the Study executed by Faculty of Mechanical Engineering, University of Belgrade[5], dispersion modeling was conducted for the entire group of heavy metals regulated under BAT-AEL (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V), assuming emissions at the maximum allowable value of 0,3 mg/Nm^3 for the group for the boiler stack. For the purpose of evaluating potential ambient air concentrations of individual metals, a conservative approach was applied whereby the entire emission limit was attributed solely to one metal at a time. In the case of arsenic, it was assumed that the full 0,3 mg/Nm^3 emission originates from arsenic alone, although actual emissions would be distributed among all metals in the group. Under this worst-case assumption, the maximum modeled annual average ground-level concentration was 1,9 ng/m^3. This is significantly below the air quality target value for arsenic of 6 ng/m^3, set by relevant regulations[6].

Given that the modeled concentrations remain well within regulatory limits even under wors-case emission scenarios and unfavorable meteorological conditions, it is conducted that arsenic emissions from the Waste-to-Energy Plant do not pose a health risk to the local population. **Additionally, the dispersion model indicates a localized distribution of pollutants, primarily toward the southeast, with concentrations decreasing significantly with distance from the source. Therefore, no transboundary impact on neighboring countries Romania and Bulgaria is expected.**

<u>Cadmium</u>

Cadmium is released into the atmosphere during the combustion of waste materials containing cadmium compounds. Cadmium primarily enters the human body through inhalation of fine particulate matter. Acute exposure to cadmium can cause severe irritation of the lungs and gastrointestinal tract, with symptoms such as coughing, chest pain, pneumonitis, and pulmonary edema. Long-term exposure may lead to kidney damage and osteoporosis.

According to the Integrated Risk Information System (IRIS)[7] of the U.S. Environmental Protection Agency (EPA), the inhalation cancer risk for cadmium is $1,8 \times 10^{-3}$ µg/m^3.This value represents the estimated additional cancer risk per unit of concentration in the air.

According to BAT-AEL[8] standards, cadmium emission limits are defined as part of the total Cd+Tl emissions, with a maximum allowable range of 0,005 to 0,02 mg/Nm^3.

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[4] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[5] Study of the influence of the Waste-to-Energy plant on the concentration of selected heavy metals in the air of the wider location of the chemical industry complex in Prahovo, March 2025, Faculty of Mechanical Engineering of the University of Belgrade

[6] Directive (EU) 2024/2881 - ambient air quality and cleaner air for Europe

[7] U.S. Environmental Protection Agency - Integrated Risk Information Sytem, IRIS (2002)

[8] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

In the Study executed by Faculty of Mechanical Engineering, University of Belgrade[9], dispersion modeling was conducted using a conservative scenario, in which the total emissions of cadmium and thallium were assumed at the maximum BAT-AEL[10] value of 0,02 mg/Nm^3 from the boiler stack. For the purpose of evaluating potential cadmium concentrations in ambient air, it was assumed that the entire emission limit of 0,02 mg/Nm^3 originates from cadmium alone, which represents a worst-case emission scenario. Based on this assumption, the maximum modeled annual average ground-level concentration for cadmium was 0,13 ng/m^3. This value is significantly below the air quality target value for cadmium of 5 ng/m^3, set by relevant regulations[11]. Given that the modeled concentration remains well within regulatory limits even under maximum emission rates and unfavorable meteorological conditions, it is concluded that cadmium emissions from the Waste-to-Energy Plant do not pose a health risk to the local population.

The spatial distribution of concentrations indicates that cadmium remains highly localized, with dispersion following predominant wind directions toward the southeast and concentrations decreasing significantly with distance from the emission source. Therefore, no transboundary impact on neighboring countries Romania and Bulgaria is expected.

Chromium

Chromium is emitted into the atmosphere through the combustion of waste containing chromium compounds. It enters the human body through the inhalation of aerosols and fine particles containing chromium compounds. Hexavalent chromium can cause respiratory tract irritation, allergic reactions, and bronchitis. Long-term exposure is associated with chronic respiratory diseases, ulceration of the nasal septum, and an increased risk of lung cancer.

The World Health Organization (WHO) does not recommend a safe level of inhalation exposure for chromium but estimates that the cancer risk at a concentration of 1 μg/m^3 is as high as 4×10^{-2} (WHO,2000a)[12]. The U.S. Environmental Protection Agency (EPA) sets a reference concentration for chronic inhalation exposure at 0,008 μg/m^3 for chromium acid aerosols and 0.1 μg/m^3 for hexavalent chromium particles (IRIS, 2002)[13].

According to BAT-AEL[14] standards, chromium emissions are included in the total heavy metal emissions (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V), with an allowable emission range of 0,01–0,3 mg/Nm^3.

[9] Study of the influence of the Waste-to-Energy plant on the concentration of selected heavy metals in the air of the wider location of the chemical industry complex in Prahovo, March 2025, Faculty of Mechanical Engineering of the University of Belgrade
[10] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)
[11] Directive (EU) 2024/2881 - ambient air quality and cleaner air for Europe
[12] Air Quality Guidelines for Europe, 2nd ed, WHO Regional Office for Europe
[13] U.S. Environmental Protection Agency - Integrated Risk Information Sytem, IRIS (2002)
[14] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

In the referenced study[15], a conservative modeling approach was applied, assuming the entire group of heavy metals, including chromium, is emitted at the maximum BAT-AEL[16] value of 0,3 mg/Nm^3 from the boiler stack. The dispersion modeling results showed that, under the assumption that the entire emission limit for the heavy metals group is attributed solely to chromium, the maximum annual average ground-level concentration of chromium was 1,9 ng/m^3. This value is well below health-based reference concentrations for chronic inhalation exposure, indicating that even in a worst-case scenario, chromium emissions do not pose a risk to human health.

The spatial dispersion of chromium indicates localized concentrations, primarily within the industrial zone, with pollutant levels decreasing significantly with distance and following dominant wind directions toward the southeast. Based on these results, no transboundary impact on neighboring countries Romania and Bulgaria is expected.

Lead

Lead is emitted into the atmosphere from waste thermal treatment facility in trace amounts, primarily in the form of lead oxides and metal particles. The main source of emissions is the combustion of waste containing lead and its compounds.

Lead enters the human body through inhalation of suspended particles (PM10 and PM2.5) that contain lead traces. Acute inhalation exposure can cause symptoms of poisoning, including abdominal pain, vomiting, headaches, and respiratory tract irritation. Long-term exposure to lead poses a serious health risk, as it can lead to nervous system damage, anemia, cardiovascular issues, and reproductive disorders. Children are particularly vulnerable to chronic lead exposure, which can cause neurological damage and developmental problems.

The World Health Organization (WHO) has set a provisional tolerable weekly intake for lead at 25 μg/kg body weight for infants and children[17]. This value is based on studies showing that at this level of exposure, lead does not accumulate in the body.

Lead emission limits are regulated as part of total heavy metal emissions (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V), with an allowable range of 0,01–0,3 mg/Nm^3 according to BAT-AEL[18] standards.

In the referenced study[19], a conservative emission scenario was used, assuming that the entire emission limit of 0,3 mg/Nm^3 is emitted solely as lead. Under this assumption, the maximum modeled

[15] Study of the influence of the Waste-to-Energy plant on the concentration of selected heavy metals in the air of the wider location of the chemical industry complex in Prahovo, March 2025, Faculty of Mechanical Engineering of the University of Belgrade

[16] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[17] Preventing disease through healthy environments, World Health Organization

[18] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[19] Study of the influence of the Waste-to-Energy plant on the concentration of selected heavy metals in the air of the wider location of the chemical industry complex in Prahovo, March 2025, Faculty of Mechanical Engineering of the University of Belgrade

annual average ground-level concentration of lead was 1,9 ng/m^3. This value is well below the air quality limit for lead, which is 0,5 µg/m^3 (or 500 ng/m^3)[20].

The modeled dispersion pattern shows that lead concentrations remain localized within the industrial zone, predominantly dispersing toward the southeast and decreasing significantly with distance from the source. Based on these results, no transboundary impact on neighboring countries Romania and Bulgaria is expected.

Mercury

The primary source of mercury emissions into the air is the combustion of waste containing mercury and its compounds in waste thermal treatment facilities. Mercury enters the human body through inhalation of vapors, with acute exposure potentially causing coughing, respiratory tract irritation, chest pain, nausea, and vomiting. Long-term exposure can lead to kidney and nervous system damage, including behavioral changes, depression, insomnia, and memory loss.

Mercury emission limits are regulated as part of total emissions, where according to BAT-AEL[21] standards, the maximum value is < 5 – 20 µg/Nm^3.

The U.S. Environmental Protection Agency (EPA) has established a reference concentration for chronic inhalation exposure to mercury[22] at 0,3 µg/m^3. In contrast, the highest modeled concentration of mercury in the atmosphere related to the planned waste thermal treatment facility was determined to be 0,0014 µg/m^3. This modeled value is significantly below the regulatory limit of 2 µg/m^3, confirming that the expected emissions are well within safe levels.

Detailed presented modeling results, indicate that mercury is not currently emitted from existing emission sources within the chemical industry complex in Prahovo. Following the construction of the thermal waste treatment plant, mercury emissions may potentially arise solely from the boiler plant stack.

Given the very low expected emission levels, as confirmed by atmospheric dispersion modeling, no transboundary impact on neighboring countries Romania and Bulgaria is anticipated.

Nickel

Nickel is emitted into the atmosphere from waste thermal treatment facilities in trace amounts. It enters the human body through inhalation of suspended particles. Acute inhalation exposure can cause respiratory tract irritation, coughing, dizziness, and nausea, while long-term exposure may result in kidney damage, pulmonary fibrosis, and an increased risk of lung cancer.

[20] Directive (EU) 2024/2881 - ambient air quality and cleaner air for Europe
[21] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)
[22] U.S. EPA, Integrated Risk Information System (IRIS) - Reference Concentration for Inhalation Exposure to Mercury

Nickel emission limits are regulated as part of total heavy metal emissions (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V), with an allowable range of 0,01–0,3 mg/Nm^3 according to BAT-AEL[23] standards.

In the referenced study[24], dispersion modeling was performed using a conservative scenario, assuming that the entire emission limit of 0,3 mg/Nm^3 for the heavy metals group is emitted solely as nickel on the boiler stack. The results showed that the highest modeled annual average ground-level concentration is 1,9 ng/m^3, which is significantly below the air quality target value for nickel[25] of 20 ng/m^3.

The spatial distribution of modeled nickel concentrations demonstrates a localized dispersion pattern, with concentrations decreasing markedly with distance from the emission source, predominantly in the southeastern direction. Based on this modeling, no transboundary impact on neighboring countries Romania and Bulgaria is expected.

<u>Suspended Particles</u>

Suspended particles PM10 and PM2.5 are emitted into the atmosphere as a result of waste combustion and ash dispersion from the chimney. PM10 and PM2.5 enter the human body through inhalation, with smaller particles penetrating deeper into the lungs, potentially causing respiratory issues, inflammation, and an increased risk of cardiovascular diseases.

According to BAT-AEL[26], the maximum allowable emission of suspended particles is <2–5 mg/Nm^3. Modeled data, presented in this chapter 6.2.1.1.5, indicate that PM10 emissions remain confined to the local industrial complex, without transboundary impact. Graphical data (Figure 6.4b) shows that the peak modeled PM10 concentration is 97,76 µg/m^3, located along the eastern boundary of the phosphogypsum landfill.

The regulatory limit for PM10 is 50 µg/m^3, while modeled values showed a peak concentration of 97,76 µg/m^3. These higher values are a direct consequence of surface emission from the phosphogypsum landfill and as such are a local phenomenon.

Considering the modeling results and the localized nature of emissions, no transboundary impact on neighboring countries Romania and Bulgaria is expected. Figure 6.4b also shows that PM10 concentrations in the direction of Romania and Bulgaria remain below 10 µg/m^3, significantly lower than the regulatory limit of 50 µg/m^3, confirming the absence of cross-border impact.

[23] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)
[24] Study of the influence of the Waste-to-Energy plant on the concentration of selected heavy metals in the air of the wider location of the chemical industry complex in Prahovo, March 2025, Faculty of Mechanical Engineering of the University of Belgrade
[25] Directive (EU) 2024/2881 - ambient air quality and cleaner air for Europe
[26] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

Sulfur Dioxide

Sulfur dioxide (SO_2) is emitted into the atmosphere as a byproduct of waste combustion containing sulfur. SO_2 enters the human body through inhalation, where short-term exposure can cause respiratory tract irritation, bronchial damage, coughing, and worsening of asthma, while long-term exposure may lead to an increased risk of chronic respiratory diseases and cardiovascular problems. Individuals with asthma, children, and the elderly are particularly sensitive to SO_2 emissions.

According to BAT-AEL[27] standards, the emission limits for SO_2 range from 5 to 30 mg/Nm^3.

Sulfur dioxide emission modeling showed that the maximum modeled hourly SO_2 concentration reached 592 μg/m^3, exceeding the regulatory limit of 350 μg/m^3. However, analysis of the modeling results indicates that these short-term emission peaks are rare and spatially limited, while the annual average SO_2 concentration is 8,57 μg/m^3, significantly below the regulatory limit og 50 μg/m^3. Graphical data (Figure 6.2b) show the distribution of maximum daily ground-level SO_2 concentrations, which remain below 10 μg/m^3 in the direction of Romania and Bulgaria, confirming that even under worst-case daily conditions, concentrations in cross-border areas are substantially below the relevant limit of 125 μg/m^3.

Given the predominantly localized nature of SO_2 emissions and the fact that short-term peaks occur only under specific meteorological conditions, no transboundary impact on neighboring countries Romania and Bulgaria is expected.

Nitrogen Oxides

Nitrogen oxides (NO_x) are a group of gases that include nitrogen monoxide (NO) and nitrogen dioxide (NO_2), primarily emitted from combustion at high temperatures. NO_x enter the human body through inhalation, where acute exposure can cause respiratory tract irritation, bronchial damage, and reduced lung function, while long-term exposure may contribute to chronic respiratory diseases and an increased risk of heart disease.

According to BAT-AEL[28] standards, NO_x emission limits range from 50 to 120 mg/Nm^3.

Nitrogen oxide emission modeling showed that all modeled NO_2 concentrations remained below regulatory limits. The maximum modeled emission values were:

- 127 μg/m^3 for the hourly maximum concentration (Figure 3.9 in the Study executed by the Faculty of Mechanical Engineering[29]) - below the 200 μg/m^3 limit

[27] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)
[28] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)
[29] Plant for energy utilization of waste and landfill of non-hazardous waste impact on air quality of the wider location of the chemical industry complex in Prahovo, April 2024, Faculty of Mechanical Engineering of the University of Belgrade.

- 44,8 μg/m^3 for the 99.79th percentile of the hourly maximum concentration (Figure 3.11 in the Study executed by the Faculty of Mechanical Engineering[30]),
- 31,1 μg/m^3 for the daily average (Figure 3.12 in the Study executed by the Faculty of Mechanical Engineering[31]),
- 1,8 μg/m^3 for the annual average concentration (Figure 3.13 in the Study executed by the Faculty of Mechanical Engineering[32]) - below the 40 μg/m^3 limit.

Analysis of the modeling results presented in chapter 6.2.1.1.5indicates that modeled maximum daily ground-level NO_2 concentrations remain well below regulatory limits. Graphical data (Figure 6.3b) show that in the broader area, including cross-border regions, NO_2 concentrations in the direction of Romania and Bulgaria remain below 10 μg/m^3, significantly below the daily limit of 85 μg/m^3.

Considering the modeling results, nitrogen oxide emissions are well controlled and do not pose a significant risk to air quality over long distances. No transboundary impact on neighboring countries Romania and Bulgaria is expected.

Dioxins and Furans

Dioxins and furans (PCDD/F) are toxic organic pollutants formed as byproducts of the combustion of chlorinated organic compounds at high temperatures. Their emissions depend on combustion efficiency and the technology used for flue gas treatment.

Dioxins enter the human body through inhalation of particles and deposition on plants that form part of the food chain. Acute exposure rarely causes severe effects, but chronic exposure may lead to liver damage, immune system dysfunction, and an increased risk of cancer.

Modern waste incineration facilities are specifically designed to destroy dioxins and furans (PCDD/F) through optimized high-temperature combustion and the use of advanced flue gas treatment technologies. Emissions of PCDD/F and dioxin-like PCBs are thereby reduced to negligible levels, fully compliant with EU and national environmental standards, and do not pose any adverse health or environmental impact beyond the immediate vicinity of the facility.

Emission limits for dioxins and furans are regulated under total PCDD/F emissions, where the BAT-AEL[33] standards set a maximum value of <0,01–0,04 ng I-TEQ/Nm^3.

Modeling has shown that the highest obtained value for the daily average was 6.6 × 10^{-3} pg/m^3, which is far below the regulatory limit of 2 μg/m^3, confirming a negligible level of emissions. These results are provided in chapter 6.2.1.1.5 and are graphically presented in Figure 6.11.

[30] Plant for energy utilization of waste and landfill of non-hazardous waste impact on air quality of the wider location of the chemical industry complex in Prahovo, April 2024, Faculty of Mechanical Engineering of the University of Belgrade.
[31] Plant for energy utilization of waste and landfill of non-hazardous waste impact on air quality of the wider location of the chemical industry complex in Prahovo, April 2024, Faculty of Mechanical Engineering of the University of Belgrade.
[32] Plant for energy utilization of waste and landfill of non-hazardous waste impact on air quality of the wider location of the chemical industry complex in Prahovo, April 2024, Faculty of Mechanical Engineering of the University of Belgrade.
[33] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

Based on the dispersion patterns displayed in Figure 6.11, the ground-level PCDD/F concentrations over Romania and Bulgaria remain below 0.001 pg/m^3, a value far beneath environmental significance thresholds, further affirming the absence of transboundary effects.

Given the low emissions and the way dioxins settle in ecosystems, no transboundary impact on neighboring countries Romania and Bulgaria is expected.

Polychlorinated Biphenyls (PCBs)

PCB compounds are present in trace amounts in emissions from waste thermal treatment plants, although their levels are strictly controlled through the prohibition of treating waste containing PCBs or more than 1% halogenated organic substances expressed as chlorine (see measures taken as a prevention protocol expressed in Chapter 8).

PCBs can enter the human body through inhalation of suspended particles and indirectly through contaminated food. Long-term exposure to PCBs can cause liver damage, hormonal imbalances, immune system suppression, and an increased risk of cancer.

Emission limits for PCBs are regulated under total PCDD/F and dioxin-like PCB emissions, with BAT-AEL standards setting a maximum value of <0,01–0,06 ng WHO-TEQ/Nm^3,

The highest modeled air concentration was 6,6 × 10^{-3} pg/m^3, which is far below the regulatory limit, confirming negligible emissions. These results are presented in chapter 6.2.1.1.5 and graphically shown in Figure 6.11 of the study.

Based on the dispersion patterns shown in chapter 6.2.1.1.5 (Figure 6.11), PCB concentrations in the air over Romania and Bulgaria are below 0.001 pg/m^3, **which is far too low to have any environmental impact, confirming that there is no transboundary effect.**

Conclusion on Transboundary Impact of Air Contaminants

The analysis of pollutant emissions from the waste thermal treatment plant indicates that overall health and environmental risks are minimal or negligible. Particular emphasis was placed on transboundary impact, with modeling results showing that the risk to the neighboring populations in Romania and Bulgaria is nearly imperceptible due to low dispersion values, the distance of populated areas, and the applied pollution control systems.

The closest Romanian settlement, Izvoarele, is located 4 km to the north, while Gruja is 7 km to the east. On the Bulgarian side, the nearest settlements are Balej (10,5 km) and Kudelin (10,6 km). Given the plant's distance from the border (750 m to Romania and 9 km to Bulgaria) and the high atmospheric dilution capacity of pollutants, no significant impact on air quality beyond the industrial zone is expected.

For most substances, including mercury, nickel, dioxins, and furans, modeled air concentrations are thousands of times below internationally recognized air quality standards, such as those set by the World Health Organization (WHO). This confirms the efficiency of the flue gas treatment system and compliance with the best available techniques (BAT)[34].

[34] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

Localized exceedances of suspended particles (PM10) and sulfur dioxide (SO_2) were recorded only within the immediate industrial zone and only for short periods under specific meteorological conditions. The highest modeled PM10 concentration of 97,76 μg/m^3 occurs exclusively near the industrial complex, while the annual average value remains well below regulatory limits. The highest SO_2 concentrations are localized and occasional, with the annual emission average remaining within safe limits.

Based on the presented modeling results and the distance of neighboring settlements, there is no significant transboundary impact of emissions from the facility on air quality in Romania and Bulgaria. Emission control, air quality monitoring, and adherence to BAT standards ensure that potential impacts remain within safe limits, posing no risk to public health or the environment in neighboring countries.

6.4.4 Assessment of Transboundary Impact of Water and Soil Pollutants and Identification of New Risk Factors

The industrial processes within the Eco Energy complex involve multiple wastewater treatment steps to minimize the release of contaminants into the Danube. Moreover, the planning incorporates installation of facilities on water retaining surfaces. Similarly, leachate water collected on the non-hazardous waste landfill is directed to wastewater treatment (please see chapter 3). Prevention of water penetration to the soil surface prevents soil contamination associated with biogenic pollution spread and the underground water pollution. The key potential sources of pollution include the flue gas scrubbing system, chemical neutralization in gas treatment, washing of solid combustion residues, and additional wastewater treatment of landfill leachate. The dominant source of hazardous material is the wastewater treatment release, while atmospheric and bio-treatment (sanitation treatment system) are considered as less pronounced points of hazard. All emission parameters in water release comply with BAT-AEL standards, while modeling indicates that the impact on water quality will be minimal, even at near controlled locations 100 and 200 meters downstream of the facility.

Danube as a recipient of wastewater is an international river relevant for the population of Romania and Bulgaria thereby a key issue in the impact assessment is whether wastewater emissions will spread and affect water quality in neighboring countries. Below is an overview of all relevant waste-to-energy characteristic contaminants and their potential effects. The reader is referred both to chapter 8 and chapter 9 for details regarding requirements for protection and monitoring of project environmental influence, developed to mitigate impact on both water and soil contamination.

Arsenic

Arsenic enters wastewater through flue gas scrubbing, washing of solid combustion residues or as a consequence of solidificate leaching. According to BAT-AEL[35] standards, the emission limits for arsenic in wastewater range from 0,01 to 0,05 mg/l, while estimated emissions are expected to remain at the lower end of this range.

Modeled values at 100 and 200 meters downstream from the release location the shown maximal concentrations of $1,4 \times 10^{-5}$ mg/l and 7×10^{-6} mg/l, as presented in chapter 6.2.1.2.1, which are 7.000

[35] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

to 14.000 times below concentrations associated with health risks. According to WHO standards, 10 µg/l is considered a threshold for increased risk of skin and bladder cancer, while the modeled values are far below.

Arsenic exposure through water can occur by drinking contaminated water or consuming food prepared with such water, as well as indirectly through bioaccumulation in fish and crops irrigated with polluted water. The intake of arsenic (primarily inorganic) from water, based on the modeled concentrations in the Danube downstream from the proposed facilities, is extremely low and cannot affect the population using the water supply.

Due to the Danube's high capacity to dilute contaminants and the extremely low modeled concentrations, no transboundary impact on Romania or Bulgaria is expected.

Cadmium

Cadmium could potentially enter wastewater through gas scrubbing, washing of solid combustion residues or as a consequence of solidificate leaching. According to BAT-AEL[36] standards, emission limits in water range from 0,005 to 0,03 mg/l, while projected emissions are expected to be closes to the lowest values of this range.

Modeled values in the Danube at 100 and 200 meters downstream from the release location are 1×10^{-5} mg/l and 5×10^{-6} mg/l maximally, as shown in chapter 6.2.1.2.1**,** which is 600 to 1.200 times lower than the average daily intake from food consumption. WHO sets a safe intake limit at 5 ng/m^3 to prevent bioaccumulation in soil and food, but the modeled emission values are far below this threshold[37].

Cadmium can enter the human body by drinking contaminated water or consuming food prepared with such water. Additionally, bioaccumulation in fish and crops irrigated with polluted water represents an indirect pathway of exposure.

The intake of cadmium (primarily inorganic) from water, as shown in concentrations in the Danube downstream from the proposed facilities, is very low and thus cannot affect the population using the water supply. It is not expected to have cadmium entering the food chain due to the limited concentration.

Although chronic cadmium exposure can cause kidney damage, osteoporosis, and cardiovascular problems, with such low modeled values, the risk of drinking water contamination is negligible. **Due to these low concentrations, no transboundary impact on neighboring countries is expected.**

Chromium

Chromium could potentially appear in water as a byproduct of gas scrubbing, washing of solid combustion residues or as a consequence of solidificate leaching. Its emissions are controlled through

[36] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)
[37] WHO Regional Office for Europe (2000). Air Quality Guidelines for Europe. Second Edition. Copenhagen: World Health Organization.

multi-phase chemical neutralization and sedimentation treatments. BAT-AEL[38] standards set maximum chromium emissions between 0,01 and 0,1 mg/l, while emissions in this project are expected to be at the lower end of this range.

Modeled maximal chromium concentrations in the Danube at 100 and 200 meters downstream range from $1{,}4 \times 10^{-5}$ mg/l to 7×10^{-6} mg/l, according to chapter 6.2.1.2.1, which is well below regulatory limits. For hexavalent chromium, which is considered particularly toxic, WHO does not specify a safe inhalation intake level but sets a water threshold of 0,1 mg/l[39], which is more than 10.000 times higher than the modeled values.

Chromium may be ingested through drinking contaminated water, but due to its strong binding to soil and low concentrations in water, exposure via water intake is negligible, and entry into the food chain is unlikely.

Predicted water concentrations downstream of the facility are negligible with respect to exposure risk. Due to the fact that chromium is bound to soil in case of deposition, it is not considered a threat for the food chain.

Based on these data, no transboundary impact on water quality in neighboring countries could be expected.

Lead

Lead could potentially enter water through flue gas scrubbing, wastewater treatment and solidificate leaching, with its emissions reduced via chemical precipitation and neutralization. BAT-AEL[40] standards set emission limits for lead in water between 0,02 and 0,06 mg/l, while projected emissions remain below these thresholds.

Modeled maximal lead concentrations in the Danube at 100 and 200 meters downstream from the release location are $1{,}1 \times 10^{-5}$ mg/l and $5{,}6 \times 10^{-6}$ mg/l, as presented in chapter 6.2.1.2.1, which is more than 1.600 times below the safe intake level for children (25 µg/kg)[41].

Lead exposure can occur by drinking contaminated water or consuming food prepared with such water. However, due to the characteristics of the area where deposition may occur, entry into the food chain is not possible.

Predicted water concentrations downstream of the facility are negligible with respect to exposure risk. It is not expected to have lead in the food chain due to the characteristics of the area where deposition can occur.

Long-term lead exposure can cause neurological disorders and developmental issues in children, but given these modeled values, the health risk is negligible or even non existing. **Due to low modeled**

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[38] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[39] US EPA IRIS (2002). Toxicological Review of Hexavalent Chromium

[40] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[41] WHO (2011). Guidelines for Drinking-water Quality, 4th ed.

concentrations, no transboundary impact on water resources in Romania and Bulgaria is expected.

Mercury

Mercury potentially found in wastewater may result from flue gas scrubbing, the treatment of solid combustion residues and solidificate leaching, but its concentration is significantly reduced through multi-phase chemical purification, including neutralization and heavy metal precipitation.

BAT-AEL[42] standards set emission limits for mercury in wastewater at <0,005–0,02 mg/l. Modeled mercury concentrations in the Danube at 100 and 200 meters downstream from the discharge point are $9{,}3 \times 10^{-7}$ mg/l and $4{,}7 \times 10^{-7}$ mg/l, as presented in chapter 6.2.1.2.1, which is more than 1.000 to 2.000 times below the WHO standard for drinking water (1 µg/l)[43]. The highest modeled mercury concentration in water is significantly below any threshold that could pose a risk to humans or aquatic ecosystems.

Mercury can pose a long-term risk through bioaccumulation in the aquatic food chain, but given the extremely low modeled emissions and the Danube's natural dilution capacity, no significant impact on the ecosystem is expected, even in the immediate vicinity of the facility, let alone in a transboundary context.

Mercury can be absorbed by drinking contaminated water, but the main pathway is bioaccumulation in aquatic organisms, especially fish. Given the very low modeled concentrations, exposure through water is negligible, even locally.

Given the wastewater treatment adopted solution, no transboundary impact of mercury emissions in water is expected. Based on predicted concentrations, exposure risk is negligible, and due to ongoing monitoring and strict regulatory emission limits, it is extremely unlikely that the general population would be exposed to mercury concentrations high enough to cause any acute effects. Finally, treatment of waste with mercury content is prohibited, reducing these risks to even lower extent (see chapter 8 for waste pre-acceptance and acceptance verification protocols).

Nickel

Nickel could potentially enter wastewater as a result of flue gas scrubbing, the treatment of solid combustion residues and solidificate leaching. BAT-AEL[44] standards set emission limits for nickel in wastewater at 0,03–0,05 mg/l, while expected emissions are at the lower end of this range.

Modeled nickel concentrations in the Danube at 100 and 200 meters downstream of the discharge point are $7{,}2 \times 10^{-5}$ mg/l and $3{,}6 \times 10^{-5}$ mg/l, as shown in chapter 6.2.1.2.1, which is more than 250 to 500 times below the WHO limit for drinking water (20 µg/l)[45].

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[42] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[43] The Water Supply (Water Quality) Regulations 2000. UK Statutory Instrument

[44] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[45] WHO (2011). Guidelines for Drinking-water Quality, 4th edition

Nickel may be ingested through consumption of contaminated water, but based on modeled concentrations, exposure risk is minimal to non-existing. There is no significant contribution to exposure via the food chain in the assessed scenario.

Predicted water concentrations downstream of the facility are negligible with respect to exposure risk. Due to the low environmental concentrations, negligible risk is expected, and no transboundary impact on water resources in Romania and Bulgaria is anticipated.

Dioxins and Furans (PCDD/F)

Dioxins and furans could potentially enter the aquatic environment through flue gas scrubbing and the treatment of solid combustion residues. However, their low solubility in water and strong tendency to bind to organic particles and sediments significantly reduce their presence in free water.

According to BAT-AEL[46] standards, the emission limits for dioxins and furans in wastewater are set at <0,01–0,06 ng WHO-TEQ/Nm^3. Modeled concentrations in the Danube at 100 and 200 meters downstream of the discharge point are maximally 2,8 × 10^{-6} ng/l and 1,4 × 10^{-6} ng/l, as presented in chapter 6.2.1.2.1, which is 3.500 to 7.000 times below the WHO recommended daily intake tolerance (2 pg TEQ/kg body weight)[47].

Exposure to dioxins through water is negligible due to their low solubility and strong binding to sediments. The main exposure route is via food, especially through animal fats and products of animal origin. Given the low concentrations, waterborne intake poses no risk.

Predicted water concentrations downstream of the facility are negligible with respect to exposure risk. Due to the extremely low emissions and their strong binding to sediments, no transboundary impact on water quality in Romania and Bulgaria is expected.

Conclusion on the Transboundary Impact of Water Contaminants

Based on emission modeling for water, all analyzed contaminants are expected to remain far below regulatory limits, minimizing any potential impact on human health and the ecosystem.

Pollutants are fully diluted in the Danube within 100 to 200 meters downstream of the discharge point, posing no risk to the Romanian and Bulgarian water bodies. Adopted technical solutions (ass described in chapter 3) provide sufficient amount of protection to exclude the risk for human health influence locally and in the trans-border context. Moreover, preventive measures outlined in chapter 8 and monitoring of wastewater release quality as presented in chapter 9, provide sufficient levels of prevention, control and reaction mechanisms to minimize any operating risk of the facility to the surrounding.

Conclusively, all modeled concentrations are several thousand times lower than international health and environmental standards (WHO, EPA, BAT-AEL).

Based on this data, no transboundary impact of water emissions on Romania and Bulgaria is expected.

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[46] Conclusions on best available techniques for waste incineration (Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) Available at Implementing decision - 2019/2010 - EN - EUR-Lex (europa.eu)

[47] FAO/WHO Joint Expert Committee on Food Additives (JECFA), 57th Meeting, 2001

6.4.5. Assessment of Potential Transboundary Noise Propagation

Noise can be a significant environmental and health concern, with its negative effects depending on intensity, exposure duration, and the distance between the noise source and residential areas. However, given the location of the Eco Energy complex, which is 750 meters from the Romanian border and 9 km from the Bulgarian border, as well as the specific characteristics of noise emissions, no transboundary impact is expected either during the construction phase or the operational phase of the facility.

Noise Impact During Construction

Noise during the construction phase primarily originates from construction activities and material transportation. Machinery and trucks generate noise in the range of 80 dB(A) to 90 dB(A), with sound pressure levels decreasing with distance, while terrain and vegetation further absorb sound waves.

Since there are no residential buildings in the immediate vicinity, and the closest cross-border settlements (Izvoarele, Gruja, Balej, Kudelin) are at least 4 km away, there is no risk of transboundary noise impact. Construction activities will be time-limited and will take place only during daylight hours, further minimizing potential effects.

Noise Impact During Facility Operation

During the operational phase, noise sources will include truck traffic and industrial process equipment. However, key noise-emitting machines (fans, cranes, shredders) will be located inside enclosed buildings, significantly reducing noise emissions into the surrounding environment.

Transport activities will be intermittent, and as the noise level from transport vehicles decreases with distance and is further mitigated by vegetation and terrain, no transboundary impact is expected. Additionally, special mitigation measures, such as unloading materials within the enclosed W-C08 facility and turning off vehicle engines during waste transfer will further reduce noise emissions. Furthermore, process emission sources are strategically spread apart as much as technically possible, which minimizes the risk of acoustic resonance and cumulative noise effects.

Based on the distance of the facility from residential areas, natural barriers, and controlled operational conditions, it can be concluded that there is no significant transboundary noise impact on settlements in Romania and Bulgaria. All noise sources are localized within the industrial zone, and the implementation of protective measures further minimizes potential environmental effects.

6.4.6 Assessment of the Transboundary Impact of Accidental Situations on Human Health

Technical details relater to accidental situation are outlined in Chapter 7 providing a detailed modeling of risks associated with the waste-to-energy facility and the non-hazardous waste landfill, including exposure analyses of ecosystems and an assessment of possible transboundary impacts. Imposed prevention requirements are further elaborated in Chapter 8, Section 8.2, where protective measures are defined, considering specific exposure factors of the ecosystem and potential transboundary pollution.

The theoretically most harmful scenarios have been modeled and presented in Chapter 7 (Tables 7.18 and 7.15), with additional assessments conducted to determine the extent to which potential incidents could impact transboundary watercourses, particularly the Danube River and groundwater flows moving toward the borders of neighboring countries.

The most prevailing events are accidents classified as relevant to the facility without implication on the industrial complex, relevant in magnitude to the complete industrial complex, and magnitude effect important from the perspective of the municipality. There are no accident scenarios classified as regional or international, ensuring full compliance with the distance from the cross-border municipalities of Bulgaria and Romania.

An accident with the greatest reach extending beyond the boundaries of the project complex, is associated with accidents involving ammonia water, as the farthest reach of toxic concentrations is 680 m. The effects of subsequent combustion remain within 11 m from the spill location, within the boundaries of the project complex.

From an additional precautionary perspective during the modeling phase, a specific scenario considering an accidental situation at the waste-to-energy plant was defined to assess the impact of a potential accident on the Danube River. A mathematical model for a continuous pollution source based on the was applied (see scenario 12 in chapter 7 for details). In this scenario, the focus was on the uncontrolled release of particulate matter (PM) from the boiler system, following a malfunction that results in the release of PM into the surrounding environment through the roof structure. This simulation aimed to evaluate the potential for harmful material transport toward the Danube under emergency conditions.

Modeling results showed that the levels of pollutants (PM and recalculated values of NH_3, HCl, HF, SO_2, and NO_x) were significantly below acceptable values, meaning that accidental situations at the waste-to-energy plant would not lead to pollution of the Danube River even in the worst-case scenario.

Based on the conducted analyses and modeling, it was concluded that even in the worst-case scenarios, there is no transboundary impact on the territories of the neighboring countries of Bulgaria and Romania, nor on the Danube water body.

All measures determined as necessary within the impact assessment of the project, regulations, and required technologies are presented in Chapter 8 of this Study. They include measures that must be taken to protect all environmental factors and human health (plans and technical solutions for environmental protection), relating to construction, regular operation, decommissioning or removal of the project, as well as measures for accident prevention during construction and operation, response measures in case of accidents, and mitigation of the consequences of potential accidents.